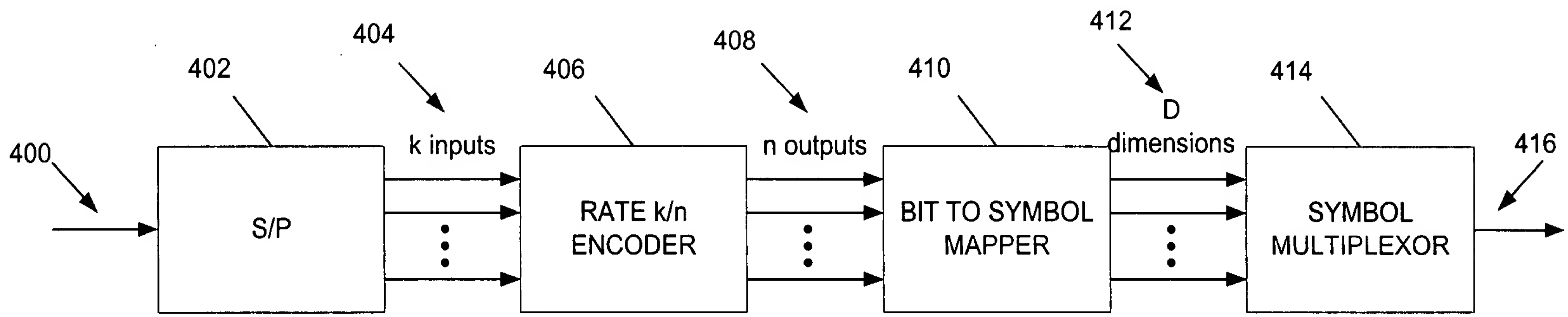


FIGURE 1

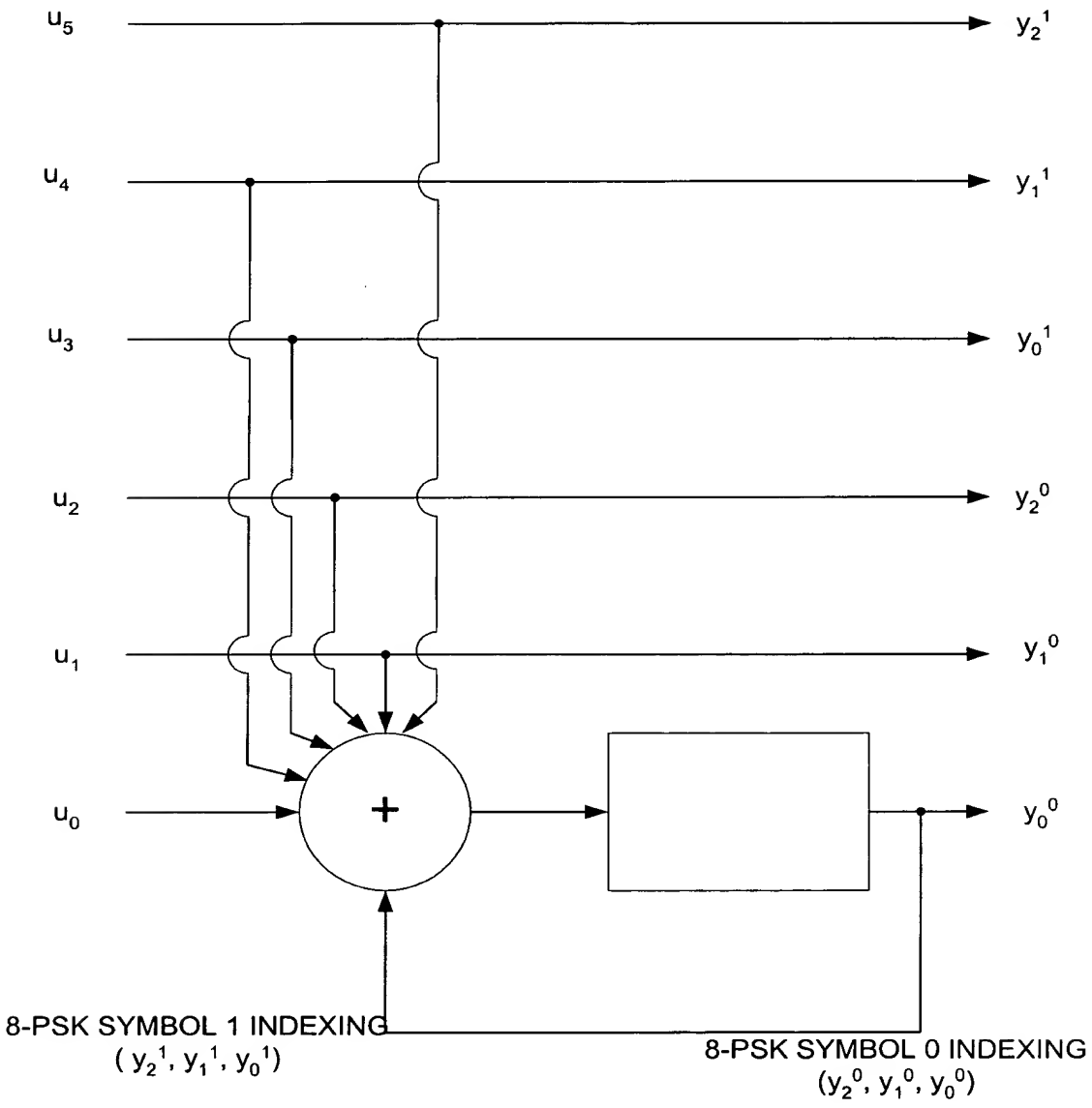

u5
u4
u3
u2
u1
u0
+
y2 1
y1 1
y0 1
y2 0
y1 0
y0 0
8-PSK SYMBOL 1 INDEXING
(y2 1, y1 1, y0 1)
8-PSK SYMBOL 0 INDEXING
(y2 0, y1 0, y0 0)

FIGURE 2

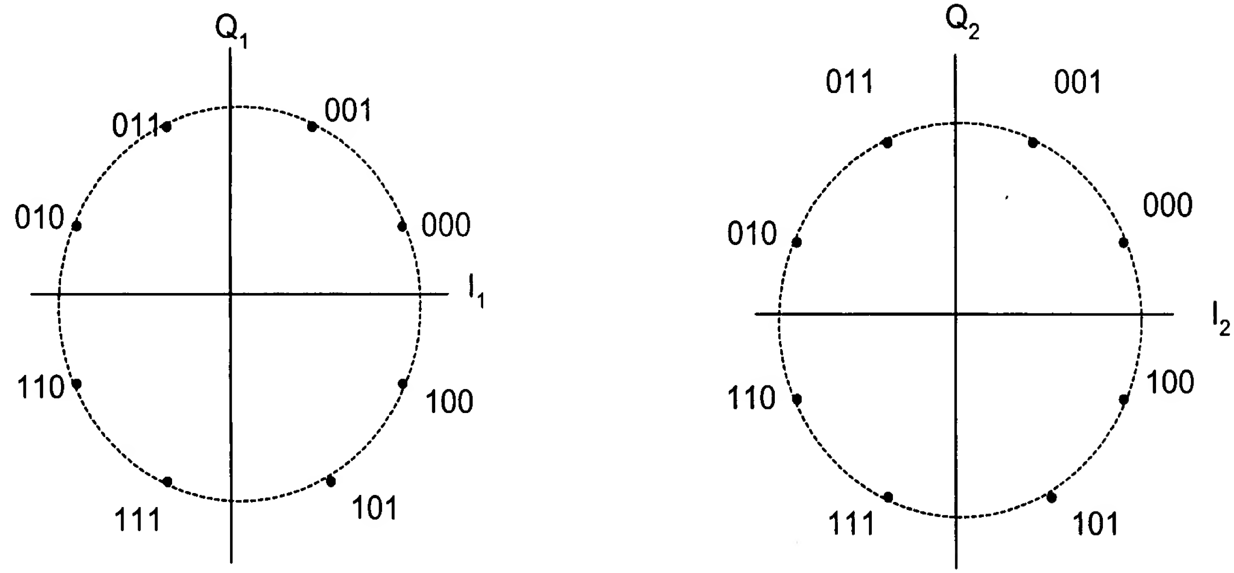

Q1
011
001
010
000
I1
110
100
111
101
Q2
011
001
000
010
I2
110
100
111
101

FIGURE 3

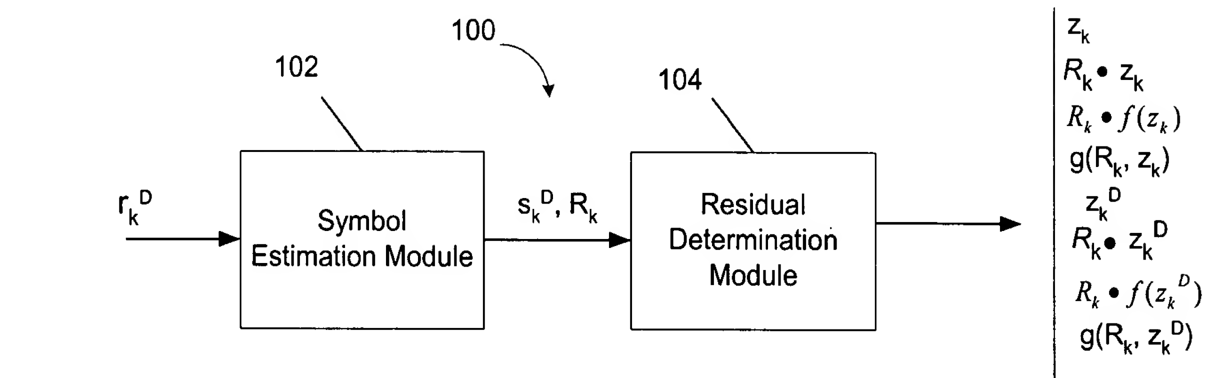


Figure 4A

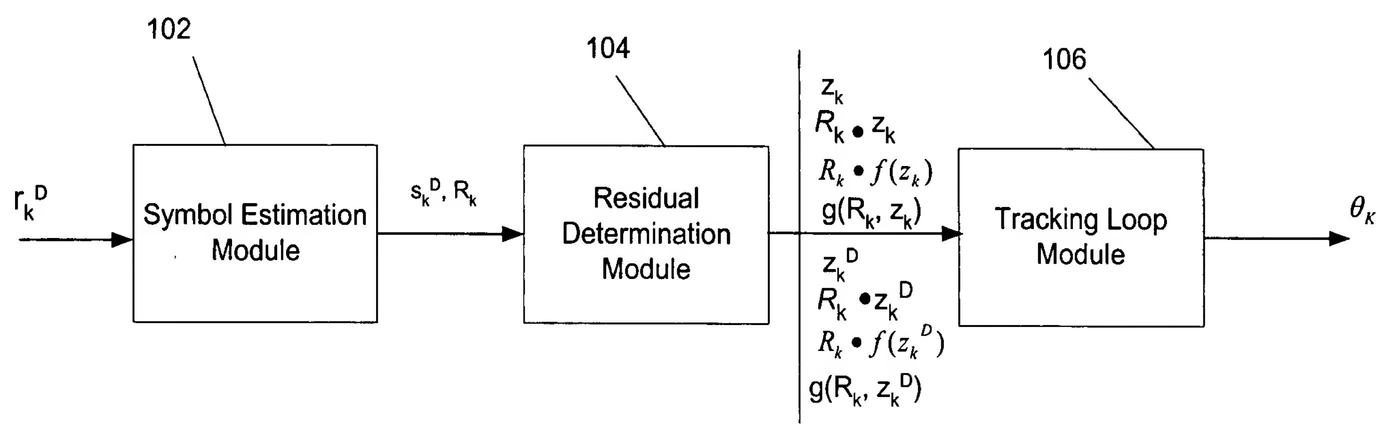
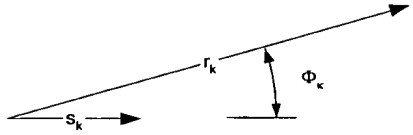


Figure 4B

$\Phi_{\kappa-1}$ = angle(r_{k-1} s^*_{k-1})
[Phase of received individual symbol referenced with respect to estimated symbol]

offset statistic fed to tracking loop, weighted by multi-dimensional symbol estimate reliability:
$o_{k-1} = R_k \Phi_{\kappa-1}$

Figure 5A

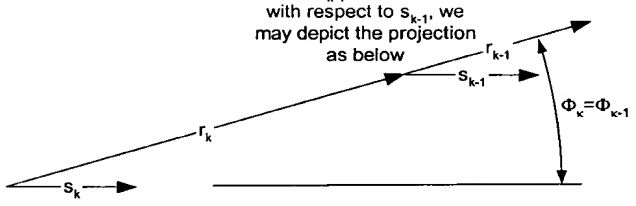


Φ_κ = angle(r_k s^*_k)
[Phase of received individual symbol referenced with respect to estimated symbol]

offset statistic fed to tracking loop, weighted by multi-dimensional symbol estimate reliability:
$o_k = R_k \Phi_\kappa$

Figure 5B

Since r_{k-1} is referenced with respect to s_{k-1}, we may depict the projection as below

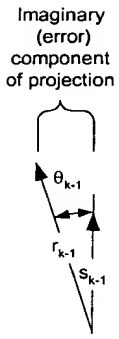


$\Phi_\kappa=\Phi_{\kappa-1}$ = angle(r_k s^*_k + r_{k-1} s^*_{k-1})
[Composite phase of received symbols each referenced with respect to estimated symbols within multi-dimensional symbol]

offset statistic fed to tracking loop, weighted by multi-dimensional symbol estimate reliability:
$o_k = o_{k-1} = R_k \Phi_\kappa$

This may be sent to tracking loop once per multi-dimensional symbol, or repeated for every individual symbol

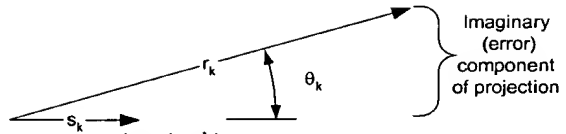
Figure 5C



$e_{k-1} = \text{imag}(r_{k-1}\, s^*_{k-1})$
[Component of received individual symbol orthogonal to estimated symbol]

offset statistic fed to tracking loop, weighted by multi-dimensional symbol estimate reliability:
$o_{k-1} = R_k\, e_{k-1}$

Figure 6A

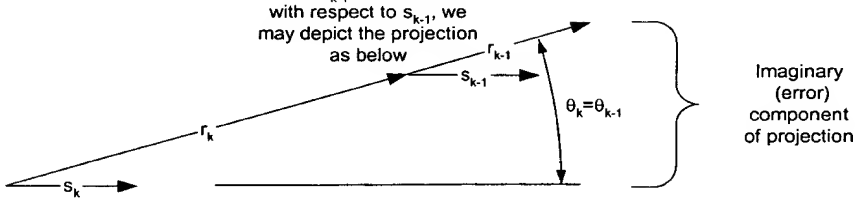


$e_k = \text{imag}(r_k\, s^*_k)$
[Component of received individual symbol orthogonal to estimated symbol]

offset statistic fed to tracking loop, weighted by multi-dimensional symbol estimate reliability:
$o_k = R_k\, e_k$

Figure 6B

Since r_{k-1} is referenced with respect to s_{k-1}, we may depict the projection as below



$e_k = e_{k-1} = \text{imag}(\, r_k\, s^*_k + r_{k-1}\, s^*_{k-1}\,)$
[Sum of orthogonal components of received symbols referenced with respect to estimated symbols]

offset statistic fed to tracking loop, weighted by multi-dimensional symbol estimate reliability:
$o_k = o_{k-1} = R_k\, e_k$

This may be sent to tracking loop once per multi-dimensional symbol, or repeated for every individual symbol

Figure 6C

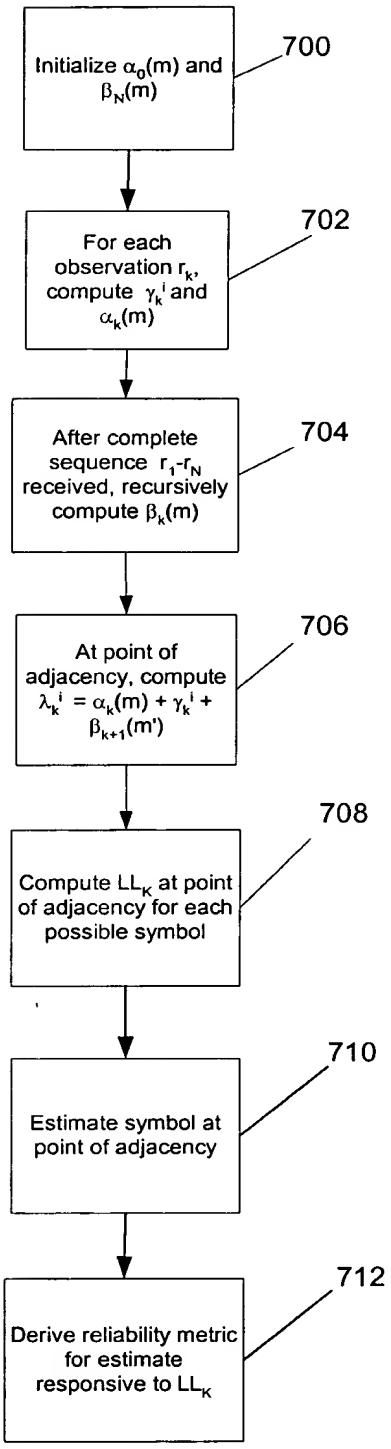

Initialize $\alpha_0(m)$ and $\beta_N(m)$
700
For each observation r_k, compute γ_k^i and $\alpha_k(m)$
702
After complete sequence r_1-r_N received, recursively compute $\beta_k(m)$
704
At point of adjacency, compute $\lambda_k^i = \alpha_k(m) + \gamma_k^i + \beta_{k+1}(m')$
706
Compute LL_K at point of adjacency for each possible symbol
708
Estimate symbol at point of adjacency
710
Derive reliability metric for estimate responsive to LL_K
712

Figure 7

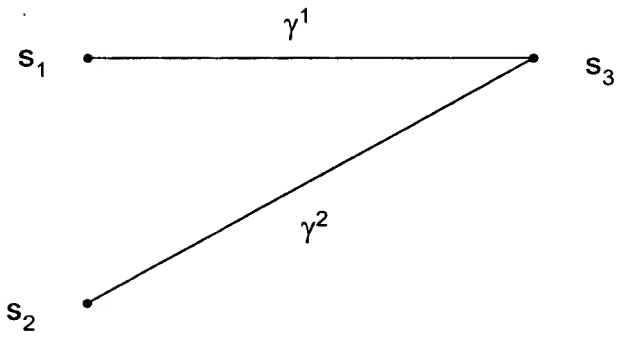


Figure 8

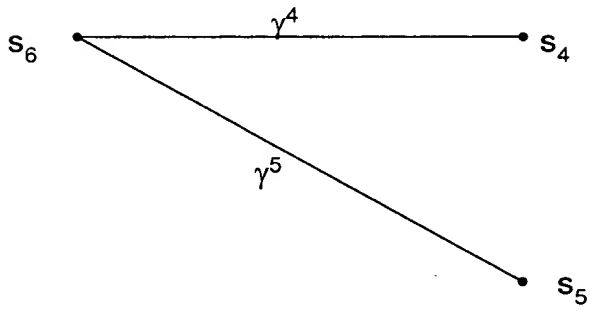


Figure 9

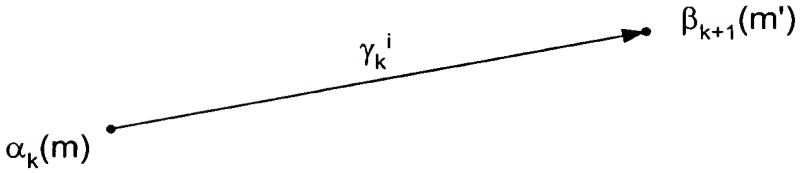


Figure 10

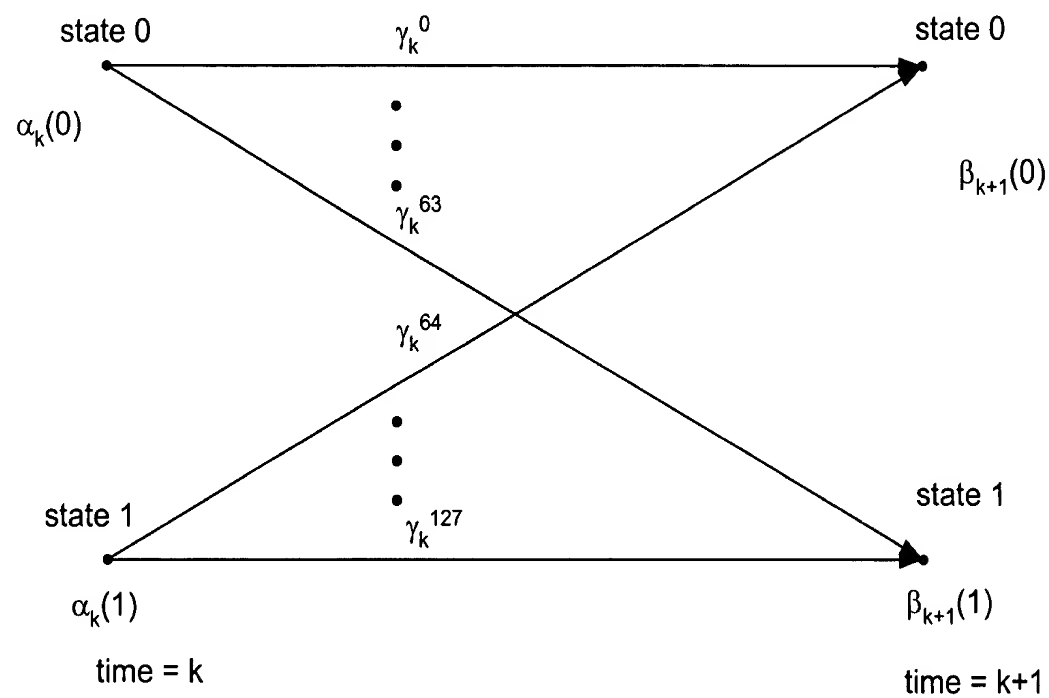

state 0
γ_k^{0}
state 0
$\alpha_k(0)$
$\beta_{k+1}(0)$
γ_k^{63}
γ_k^{64}
state 1
γ_k^{127}
state 1
$\alpha_k(1)$
$\beta_{k+1}(1)$
time = k
time = k+1

Figure 11